CLAIMS

1. A method of manufacturing single-crystal semiconductor wafers, wherein a plurality of single-crystal semiconductor wafers of a relatively small diameter (2a-d) desired by users are cut out from a single-crystal semiconductor wafer of a relatively large diameter (1a-1d).

2. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein said semiconductor is a compound semiconductor.

3. The method of manufacturing single-crystal semiconductor wafers according to claim 2, wherein said compound semiconductor is selected from the group consisting of GaAs, InP, and GaN.

4. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein said large-scale wafer has a thickness in a range of 0.15 mm to 1.5 mm.

5. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein said small-scale wafers are cut out by a method selected from the group consisting of a laser method, an electric discharge machining method, a wire saw method, an ultrasonic method, and a grinding method by means of a cylindrical core on which diamond is electrically deposited.

6. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein at least three said small-scale wafers having a diameter of 2 inches or more are cut out from said large-scale wafer having a diameter of 4 inches or more.

7. The method of manufacturing single-crystal semiconductor wafers according to claim 6, wherein at least four said small-scale wafers having a diameter of 2 inches or more are cut out from said large-scale wafer having a diameter of 5 inches or more.

8. The method of manufacturing single-crystal semiconductor wafers according to claim 7, wherein at least seven said small-scale wafers having a diameter of 2 inches or more are cut out from said large-scale wafer having a diameter of 6 inches or more.

9. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein a total main surface area of said small-scale wafers cut out from said large-scale wafer corresponds to at least 50% of a main surface area of said large-scale wafer.

10. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein defective parts included in said large-scale wafer correspond to at most 65% of a main surface area of said large-scale wafer.

11. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein said small-scale wafers are cut out from a plurality of said large-scale wafers in a stacked state.

12. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein each of said small-scale wafers has a mark for indicating a part of said large-scale wafer from which each of said small-scale wafers is cut out.

13. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein each of said small-scale wafers has an orientation flat and an index flat.

14. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein each of said small-scale single-crystal semiconductor wafers is cut out to have a protruding margin to be gripped when cleavage is carried out so as to form an orientation flat.

15. The method of manufacturing single-crystal semiconductor wafers according to claim 14, wherein each of said small-scale wafers has, in said protruding margin, a mark for indicating a part of said large-scale wafer from which each of said small-scale wafers is cut out.

16. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein each of said small-scale wafers has a notch for easy determination of its crystal orientation and alignment.

17. The method of manufacturing single-crystal semiconductor wafers according to claim 1, wherein said small-scale wafers are cut out by using a YAG laser beam.

18. The method of manufacturing single-crystal semiconductor wafers according to claim 17, wherein said YAG laser is a pulse laser.

19. The method of manufacturing single-crystal semiconductor wafers according to claim 18, wherein said small-scale wafers are cut out such that a plurality of holes in said large-scale wafer each made by a single shot of said pulse laser are aligned successively with the neighboring holes overlapping each other in a range of 30% to 87% of their diameters.

20. The method of manufacturing single-crystal semiconductor wafers according to claim 17, wherein said large-scale wafer has a main surface as sliced from an ingot, a main surface subsequently washed, or a main surface after a surface layer is etched away by a thickness of at most 10 μm, and said main surface is irradiated with said laser beam.

21. The method of manufacturing single-crystal semiconductor wafers according to claim 17, wherein said large-scale wafer before cutting is supported by a plurality of supporting means for supporting the plurality of said small-scale wafers to be obtained after cutting.

22. The method of manufacturing single-crystal semiconductor wafers according to claim 21, wherein each of said supporting means has a supporting area smaller than each of said small-scale wafers.

23. The method of manufacturing single-crystal semiconductor wafers according to claim 22, wherein each of said supporting means is a vacuum chuck.

24. The method of manufacturing single-crystal semiconductor wafers according to claim 22, wherein each of said supporting means is a pinholder, and a weight is placed on the wafer and arranged above said pinholder or a magnet is placed on the wafer and arranged above said pinholder having a magnetic property, so as to support said wafer more stably.

25. The method of manufacturing single-crystal semiconductor wafers according to claim 17, wherein a gas jet is given to blow off residues caused during cutting with said laser beam.

26. The method of manufacturing single-crystal semiconductor wafers according to claim 25, wherein said gas and said residues are sucked and introduced into a dust collector.

27. The method of manufacturing single-crystal semiconductor wafers according to claim 25, wherein said laser beam is adjusted such that an opening made by cutting with said laser beam has a width larger on a main surface side of said wafer to which the laser beam is incident than on the other main surface side, and a side surface of the opening is made at an angle ranging from 65 to 85 degrees with respect to the main surface of said wafer.

28. The method of manufacturing single-crystal semiconductor wafers according to claim 17, wherein each of said small-scale wafers has a mark for indicating that each of them is cut out from what part of each of plurality of said large-scale wafers sliced from the same ingot, and said small-scale wafers cut out from the corresponding parts of said large-scale wafers are grouped into the same lot.

29. The method of manufacturing single-crystal semiconductor wafers according to claim 17, wherein residues caused during cutting and adhered to a periphery of each of said small-scale wafers are removed by rubbing.

30. The method of manufacturing single-crystal semiconductor wafers according to claim 29, wherein a peripheral side layer of each of said small-scale wafers is removed by a grinding allowance of at most 0.3 mm with a grinder of rubber.

31. The method of manufacturing single-crystal semiconductor wafers according to claim 30, wherein said peripheral side layer is removed by a grinding allowance of at most 0.1 mm, and either edge or both edges of the peripheral side are

beveled by a grinder of rubber.

32. The method of manufacturing single-crystal semiconductor wafers according to claim 30, wherein the entire surface of each of said small-scale wafers is etched to remove contaminations after the wafer's periphery is processed by the grinder of rubber.

33. A laser machining apparatus for cutting out a plurality of single-crystal semiconductor wafers of a relatively small diameter from a single-crystal semiconductor wafer of a relatively large diameter by a laser beam, comprising:

a plurality of supporting means (12) for supporting from underneath a plurality of regions to be cut out from said large-scale wafer to provide the plurality of said small-scale wafers;

a laser device including a laser beam window (13) supported by an XY stage above the wafer; and

a gas ejector (16) for giving a gas jet to blow off residues caused during cutting with the laser beam.

34. The laser machining apparatus according to claim 33, wherein each of said supporting means includes a vacuum chuck or a pinholder, and has a supporting area smaller than a main surface of each of said small-scale wafers.

35. The laser machining apparatus according to claim 34, wherein each of said supporting means includes a pinholder having a magnetic property, and further includes a magnet to be placed on said wafer and arranged above the pinholder.

36. The laser machining apparatus according to claim 33, wherein said gas ejector as well as said laser device is supported by said XY stage.

37. The laser machining apparatus according to claim 33, further comprising a dust collector for sucking the gas and the residues below said wafer to remove the residues.

38. The laser machining apparatus according to claim 33, wherein said laser device is a YAG laser device.

39. The laser machining apparatus according to claim 38, wherein said YAG laser device is a pulse laser device.

40. The laser machining apparatus according to claim 33, wherein said laser beam window (13) is connected to a laser generating source (15) via an optical fiber (14).